

WHAT IS CLAIMED IS:

- 1 1. A liquid composition suitable for the etching and simultaneous
2 desmutting of aluminum and aluminum alloys, comprising water and:
3 (A) an acid source comprising sulfuric acid and nitric acid; and
4 (B) a non-fluorine containing etchant source comprising
5 phosphoric acid; and
 (C) a stabilized oxidant comprising one or more compounds that are
capable of oxidizing and/or ionizing ground state metals.
- 1 2. The liquid composition of claim 1, wherein the (C) stabilized
2 oxidant comprises molybdate and/or condensed molybdate ions.
- 1 3. The liquid composition of claim 1, wherein the liquid
2 composition further comprises (D) a wetting agent and/or a degassing agent.
- 1 4. The liquid composition of claim 1, wherein the liquid
2 composition further comprises (E) a complexing agent and/or a grain modifier.
- 1 5. The liquid composition of claim 3, wherein the liquid
2 composition further comprises (E) a complexing agent and/or a grain modifier.
- 1 6. The liquid composition of claim 1, wherein the sulphuric acid
2 is present in an amount of 10 to 50 weight percent, based on the total weight of the
3 liquid composition, the nitric acid is present in an amount of 0.5 to 15 weight
4 percent, based on the total weight of the liquid composition, the phosphoric acid is
5 present in an amount of 25 to 90 weight percent, based on the total weight of the
6 liquid composition, and the stabilized oxidant is present in an amount less than 2
7 weight percent, based on the total weight of the liquid composition.
- 3 liquid composition, the nitric acid is present in an amount of 0.5 to 15 weight

4 percent, based on the total weight of the liquid composition, the phosphoric acid is
5 present in an amount of 25 to 90 weight percent, based on the total weight of the
6 liquid composition, and the stabilized oxidant is present in an amount less than 2
7 weight percent, based on the total weight of the liquid composition.

1 8. The liquid composition of claim 6, wherein the sulphuric acid
2 is present in an amount of 12 to 35 weight percent, based on the total weight of the
3 liquid composition, the nitric acid is present in an amount of 1 to 10 weight percent,
4 based on the total weight of the liquid composition, the phosphoric acid is present
5 in an amount of 35 to 85 weight percent, based on the total weight of the liquid
6 composition, and the stabilized oxidant is present in an amount of 0.01 to 0.75
7 weight percent, based on the total weight of the liquid composition.

1 9. The liquid composition of claim 8, wherein the sulphuric acid
2 is present in an amount of 18 to 25 weight percent, based on the total weight of the
3 liquid composition, the nitric acid is present in an amount of 2.5 to 7.5 weight
4 percent, based on the total weight of the liquid composition, the phosphoric acid is
5 present in an amount of 45 to 70 weight percent, based on the total weight of the
6 liquid composition, and the stabilized oxidant is present in an amount of 0.05 to .25
7 weight percent, based on the total weight of the liquid composition.

1 10. The liquid composition of claim 5, wherein component (D)
2 is present in an amount less than 0.1 weight percent, based on the total weight of
3 the liquid composition.

1 11. The liquid composition of claim 5, wherein the component (E)
2 is present in an amount of less than 10 weight percent, based on the total weight of
3 the liquid composition.

1 13. The liquid composition of claim 1, wherein the liquid
2 composition comprises water and:

- 3 (1) diluted sulphuric acid;
4 (2) nitric acid;
5 (3) phosphoric acid;
6 (4) molybdate and/or condensed molybdate ions;
7 (5) a perfluoroalkyl sulfonate; and
8 (6) aluminum sulfate.

1 14. The liquid composition of claim 13, wherein the diluted
2 sulphuric acid comprises an aqueous solution of sulphuric acid containing less than
3 80 weight percent sulphuric acid, based on the total weight of the aqueous sulphuric
4 acid solution, with the diluted sulphuric acid being present in the liquid composition
5 in an amount of 10 to 50 weight percent, based on the total weight of the liquid
6 composition, wherein the nitric acid comprises an aqueous nitric acid solution
7 containing nitric acid in an amount between 45 and 75 weight percent, based on the
8 total weight percent of the nitric acid solution, with the nitric acid solution being
9 present in the liquid composition in an amount of between 0.5 and 15 weight
10 percent, based on the total weight of the liquid composition, wherein the phosphoric
11 acid comprises an aqueous phosphoric solution containing the phosphoric acid in an
12 amount less than 95% weight percent, based on the total weight of the aqueous
13 phosphoric acid solution, with the phosphoric acid solution being present in the
14 liquid composition in an amount of between 25 to 90 weight percent, based on the
15 total weight of the liquid composition, wherein the component (4) is present in the
16 liquid composition in an amount of less than 2 weight percent, based on the total
17 weight of the liquid composition, wherein the perfluoroalkyl sulfonate is present in
18 the liquid composition in an amount of less than 0.1 weight percent, based on the
19 total weight of the liquid composition, wherein the aluminum sulfate is present in
20 the liquid composition in an amount of less than 10 weight percent, based on the

- 3 (1) diluted sulphuric acid;
- 4 (2) nitric acid;
- 5 (3) phosphoric acid;
- 6 (4) molybdate and/or condensed molybdate ions;
- 7 (5) a perfluoropolyether sulfonate salt.

1 19. The method of claim 18, wherein the liquid composition is
2 made by adding the water to a mixing tank, agitating the water, then adding the
3 diluted sulphuric acid to the mixing tank, then sifting in the molybdate (4) and
4 mixing until dissolved, then mixing in the nitric acid, the phosphoric acid, the
5 perfluoroalkyl sulfonate, and the aluminum sulfate until a uniform composition
6 results.

1 20. The method of claim 18, wherein the method further
2 comprises rinsing the article with water after exposing the article to the liquid
3 composition.

4 21. A liquid composition suitable for the etching and simultaneous
5 desmutting of aluminum and aluminum alloys, comprising water and:

- 6 (1) diluted sulphuric acid;
7 (2) nitric acid;
8 (3) phosphoric acid; and
9 (4) molybdate and/or condensed molybdate ions.